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CHEMICAL ANALYSES OF COAL SAMPLES CORED DURING 1979 FROM THE WASATCH AND FORT UNION FORMATIONS, CAMPBELL COUNTY, WYOMING

By

Rodney J. Noah and Thomas P. Lonnie

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This report has not been edited for conformity with Minerals Management Service and U.S. Geological Survey editorial standards or stratigraphic nomenclature.

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CONVERSION TABLE

To convert ENGLISH UNITS	Multiply by	To obtain METRIC UNITS
Feet	0.3048	Meters
Btu/lb	2.324	Joule/Kilogram
Btu/lb	.5556	Kcal/Kilogram
Fahrenheit	$\frac{(°F - 32)}{1.8}$	Celsius

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INTRODUCTION

During 1979, eight core holes were drilled and coal samples were obtained from the Tertiary Wasatch and Fort Union Formations in Campbell County, Wyo. (fig. 1). The drilling was done as part of the U.S. Geological Survey's (USGS) program to evaluate and classify mineral lands in the public domain. The purpose of the program is to gather data on the thickness, quality, extent, and recoverability of coal beds, and the lithologic characteristics of the surrounding rocks in the Wasatch and Fort Union Formations of the Powder River Basin, Wyo., for pre-lease tract evaluation. Similar information has been reported in earlier reports (Babcock and Hobbs, 1979; Hobbs, 1980a, 1980b; Kistner, 1977, 1980; Kistner and others 1979, 1980; Lonnie and others, 1980; U.S. Geological Survey and Montana Bureau of Mines and Geology, 1973, 1974, 1976a, 1976b, 1977, 1978).

The core holes are located by section, township, range, and distance (in ft) from the nearest section lines (fig. 1). Surface elevations were obtained by hand leveling from known elevations on USGS 7 1/2-minute topographic maps (table 1).

Core samples were collected using a conventional rotary-drill rig, with water as the usual drilling fluid. A pilot hole was drilled first and a geophysical log containing natural gamma-ray, resistance, and spontaneous potential was obtained (Lonnie and others, 1980). The geophysical log was then used to determine the depth and thickness of each coal bed (table 1). The drill rig was then moved a short distance and a new hole was drilled with only the coal intervals being cored. The core recovered was 2 1/8 in. in diameter and a maximum of 15 ft in length.

Core samples were sealed in plastic core sleeves, placed in waxed core boxes, and shipped as soon as possible to the USGS Analytical Laboratory in Denver, Colo. Sample numbers were assigned and representative splits were made from each sample--one for routine coal analysis and the other for major composition and trace-element composition of the coal ash (Swanson and Huffman, 1976, fig. 1, p. 5).

Coal analyses (U.S. Bureau of Mines, 1967) by the U.S. Department of Energy, Pittsburgh, Penn., include proximate, ultimate, heating value, sulfur forms, and ash-fusion temperature for coal as received, moisture free, and moisture and ash free (table 2). Determinations of major- and trace-element compositions of the coal ash by the USGS Analytical Laboratory have not been completed.

Caution should be used when viewing the results of the coal analyses presented in this report. Although the core samples were collected and sealed carefully, changes in moisture content are possible, and recirculated drilling fluid is a possible source of contamination for moisture, ash, and sulfur contents. It should also be noted that coal beds are not homogeneous and that the coal analysis from a 2 1/8-in.-diameter core sample may be atypical of the surrounding coal bed.

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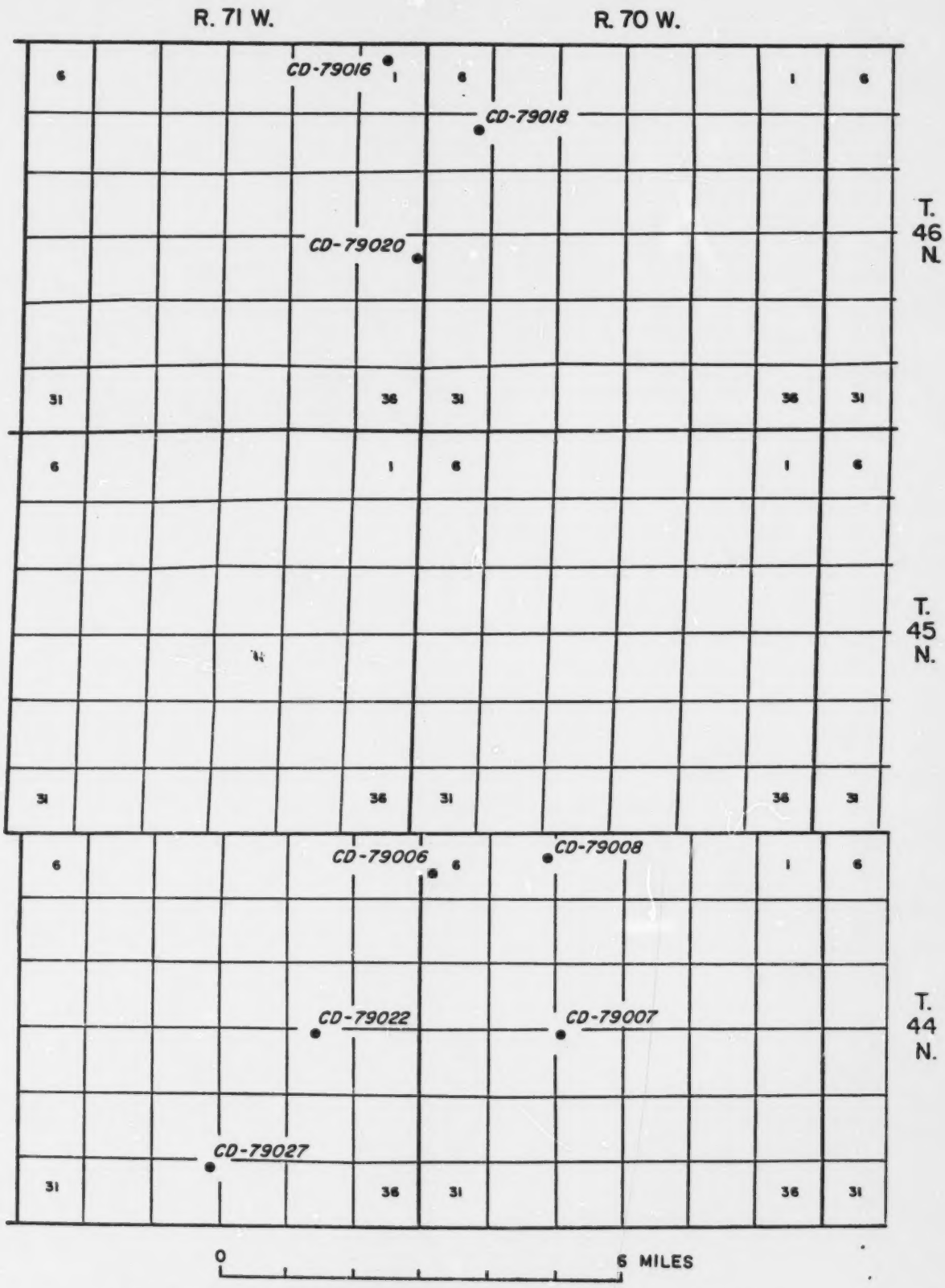

Figure 1. Location of core holes drilled during 1979 in Campbell County, Wyoming

Table 1.--Core-hole locations and sample data from drilling in the Wasatch and Fort Union Formations, Campbell County, Wyoming

Core-hole No.	Location Sec.	T. N.	R. W.	Elevation (ft)	USGS sample No.	Cored interval (ft)	Coal bed name
CD-79018	7	46	70	4,793	D218908	25 - 29.5	Unnamed
	1,990 FNL		1,240 FEL		D218909	47 - 53.6	Unnamed
					D218910	90 -114.6	Wyodak
					D218911	115.2-132	Wyodak
					D218912	134.8-136.3	Wyodak
CD-79022	23	44	71	4,812	D218913	309.4-315.5	Wyodak
	80 FNL		2,520 FWL		D218914	316 -326.1	Wyodak
					D218915	331 -359	Wyodak
					D218916	359 -381.5	Wyodak
CD-79020	24	46	71	4,598	D218917	25 - 29.5	Unnamed
	2,045 FNL		575 FEL		D218918	47 - 53.6	Unnamed
					D218919	90 -114.6	Wyodak
					D218920	115.2-132	Wyodak
					D218921	134.8-136.3	Wyodak
CD-79016	1	46	71	4,550	D218922	37.5- 43.9	Unnamed
	1,520 FNL		2,360 FWL		D218923	60.1- 77	Unnamed
					D218924	80 -100.8	Wyodak
					D218925	100.8-114.6	Wyodak
CD-79008	5	44	70	4,816	D218926	75 - 79	Unnamed
	2,200 FNL		515 FEL		D218927	98.5-107.7	Unnamed
					D218928	108.9-134.5	Wyodak
CD-79006	6	44	70	4,839	D218929	175 -176	Unnamed
	1,930 FSL		700 FWL		D218930	184.1-198.2	Wyodak
					D218931	198.1-220.9	Wyodak
CD-79007	21	44	70	4,935	D218932	262.9-263.9	Unnamed
	80 FNL		300 FWL		D218933	265.4-276.4	Unnamed
					D218934	280 -302.5	Wyodak
					D218935	305 -308.1	Wyodak
					D218936	308.8-310.8	Wyodak
					D218937	318.2-323.3	Wyodak
CD-79027	33	44	71	4,776	D221583	402 -445.6	Wyodak
	500 FNL		500 FEL		D221584	450 -503.1	Wyodak
					D221585	503.6-509.3	Wyodak

Table 2.--Coal analyses of coal samples from the Wyodak and unnamed beds, Wasatch and Fort Union Formations, Campbell County, Wyoming.

[Analyses by U.S. Department of Energy, Pittsburgh, Pa. Type of analysis: A, as received; B, moisture free; C, moisture and ash free; ---, no data]

Sample No.	Type of analysis	Proximate analysis (percent)				Ultimate analysis (percent)					Heating value (Btu/lb)	Forms of sulfur (percent)			Ash-fusion temp. (°F)		
		Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur		Sulfate	Pyritic	Organic	Initial deformation	Softening	Fluid
D218908	A	26.9	32.8	32.6	7.7	6.7	48.6	1.1	35.1	0.9	8,563	0.01	0.15	0.70	2,010	2,130	2,230
	B	---	44.9	44.6	10.5	5.1	66.4	1.5	15.3	1.2	11,707	.01	.20	.96			
	C	---	50.1	49.9	---	5.7	74.2	1.7	17.1	1.3	13,077	.01	.23	1.07			
D218909	A	26.9	27.6	29.9	15.6	6.1	41.3	1.0	35.5	.5	7,170	.01	.03	.47	2,200	2,320	2,440
	B	---	37.7	41.0	21.3	4.2	56.5	1.4	15.8	.7	9,804	.01	.04	.64			
	C	---	47.9	52.1	---	5.4	71.8	1.8	20.1	.9	12,461	.01	.05	.81			
D218910	A	24.2	32.6	37.2	6.0	6.5	51.9	1.1	34.1	.5	8,973	.01	.10	.38	2,030	2,110	2,200
	B	---	43.0	49.1	7.9	5.0	68.4	1.5	16.6	.6	11,837	.01	.13	.50			
	C	---	46.6	53.4	---	5.4	74.3	1.6	18.0	.7	12,847	.01	.14	.54			
D218911	A	29.5	28.1	36.6	5.8	6.4	48.1	1.1	38.2	.5	8,215	.01	.08	.38	1,910	2,000	2,110
	B	---	39.8	52.0	8.2	4.5	68.2	1.5	16.9	.7	11,654	.01	.11	.53			
	C	---	43.4	56.6	---	4.9	74.3	1.7	18.4	.7	12,696	.01	.12	.58			
D218912	A	25.1	29.3	32.4	13.2	6.1	44.9	1.1	34.1	.5	7,764	.01	.06	.48	2,390	2,460	2,530
	B	---	39.1	43.2	17.7	4.5	59.9	1.5	15.7	.7	10,371	.01	.07	.64			
	C	---	47.5	52.5	---	5.4	72.8	1.8	19.1	.9	12,594	.01	.09	.78			
D218913	A	20.5	34.8	37.5	7.2	6.3	53.4	1.1	30.8	1.1	9,492	.01	1.03	.10	2,040	2,160	2,250
	B	---	43.8	47.1	9.1	5.1	67.2	1.4	15.9	1.4	11,939	.01	1.29	.13			
	C	---	48.1	51.9	---	5.6	73.9	1.5	17.4	1.6	13,129	.01	1.42	.14			
D218914	A	22.7	32.5	38.4	6.4	6.3	52.8	1.1	32.7	.7	9,191	.01	.12	.57	2,040	2,130	2,240
	B	---	42.0	49.7	8.3	4.9	68.3	1.4	16.2	.9	11,884	.01	.15	.74			
	C	---	45.8	54.2	---	5.4	74.5	1.5	17.6	1.0	12,963	.01	.16	.81			
D218915	A	22.7	32.6	40.3	4.4	6.3	54.1	1.0	33.9	.3	9,370	.00	.03	.27	2,340	2,420	2,490
	B	---	42.2	52.1	5.7	4.9	70.0	1.3	17.8	.4	12,125	.01	.04	.35			
	C	---	44.8	55.2	---	5.2	74.2	1.4	18.8	.4	12,851	.01	.05	.37			
D218916	A	23.9	30.9	39.7	5.5	6.2	52.8	1.0	34.2	.3	9,077	.01	.02	.23	2,140	2,260	2,340
	B	---	40.7	52.1	7.2	4.7	69.5	1.4	17.0	.3	11,932	.01	.03	.31			
	C	---	43.8	56.2	---	5.0	74.9	1.5	18.3	.4	12,859	.01	.03	.33			

Table 2.—Coal analyses of coal samples from the Wyodak and unnamed beds, Wasatch and Fort Union Formations, Campbell County, Wyoming--Continued

Sample No.	Type of analysis	Proximate analysis (percent)				Ultimate analysis (percent)					Heating value (Btu/lb)	Forms of sulfur (percent)			Ash-fusion temp. (°F)		
		Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur		Sulfate	Pyritic	Organic	Initial deformation	Softening	Fluid
D218917	A	19.8	31.2	29.9	19.1	5.7	44.3	1.1	28.6	1.1	7,915	0.00	0.31	0.83	2,260	2,370	2,440
	B	---	38.9	37.3	23.8	4.4	55.3	1.3	13.7	1.4	9,875	.01	.39	1.03			
	C	---	51.1	43.9	---	5.7	72.6	1.7	18.0	1.9	12,958	.01	.51	1.36			
D218918	A	23.6	33.6	33.1	9.7	6.4	49.3	1.1	32.8	.8	8,787	.01	.07	.72	2,100	2,180	2,270
	B	---	44.0	43.4	12.6	4.9	64.5	1.4	15.5	1.0	11,495	.01	.09	.94			
	C	---	50.4	49.6	---	5.6	73.8	1.6	17.8	1.2	13,157	.01	.10	1.08			
D218919	A	25.8	30.9	37.3	6.0	6.5	50.7	1.1	35.3	.4	8,790	.00	.05	.37	2,030	2,120	2,200
	B	---	41.6	50.4	8.0	4.9	68.4	1.5	16.7	.6	11,851	.00	.06	.50			
	C	---	45.3	54.7	---	5.3	74.4	1.6	18.1	.6	12,886	.00	.07	.54			
D218920	A	26.3	29.8	37.8	6.1	6.3	50.3	1.1	35.9	.3	8,617	.00	.02	.28	2,180	2,250	2,330
	B	---	40.5	51.2	8.3	4.6	68.2	1.5	17.0	.4	11,695	.00	.03	.37			
	C	---	44.1	55.9	---	5.0	74.4	1.6	18.5	.4	12,747	.00	.04	.41			
D218921	A	25.7	31.7	35.4	7.2	6.5	49.5	1.2	34.8	.8	8,696	.00	.02	.78	2,360	2,420	2,500
	B	---	42.6	47.7	9.7	4.9	66.6	1.5	16.2	1.1	11,703	.01	.02	1.05			
	C	---	47.2	52.8	---	5.4	73.8	1.7	17.9	1.2	12,965	.01	.02	1.16			
D218922	A	21.3	34.7	35.4	8.6	6.2	51.2	1.1	32.1	.9	8,988	.00	.08	.81	2,260	2,340	2,420
	B	---	44.1	45.0	10.9	4.9	65.0	1.4	16.7	1.1	11,424	.00	.10	1.03			
	C	---	49.5	50.5	---	5.5	73.0	1.6	18.7	1.3	12,817	.00	.11	1.16			
D218923	A	27.4	29.4	32.2	11.0	6.3	45.2	1.0	36.1	.5	7,822	.00	.05	.44	2,320	2,410	2,500
	B	---	40.5	44.4	15.1	4.5	62.2	1.3	16.2	.7	10,772	.01	.07	.60			
	C	---	47.7	52.3	---	5.3	73.2	1.6	19.0	.8	12,686	.01	.09	.71			
D218924	A	29.4	29.4	34.8	6.4	6.7	47.8	1.0	37.7	.4	8,219	.00	.09	.31	2,190	2,250	2,320
	B	---	41.6	49.3	9.1	4.8	67.7	1.4	16.4	.6	11,647	.01	.12	.44			
	C	---	45.8	54.2	---	5.3	74.5	1.5	18.0	.6	12,817	.01	.14	.48			
D218925	A	28.9	28.6	36.2	6.3	6.6	48.0	1.0	37.7	.3	8,301	.00	.02	.32	2,010	2,120	2,210
	B	---	40.3	50.8	8.9	4.7	67.6	1.4	16.9	.5	11,682	.00	.03	.45			
	C	---	44.3	55.7	---	5.2	74.2	1.6	18.6	.3	12,825	.00	.04	.49			
D218926	A	27.2	30.3	29.7	12.8	6.4	44.1	1.4	34.4	1.4	7,890	.00	.75	.39	2,170	2,250	2,340
	B	---	41.6	40.8	17.6	4.6	60.6	1.5	14.1	1.6	10,838	.01	1.03	.53			
	C	---	50.5	49.5	---	5.6	73.5	1.8	17.1	1.9	13,152	.01	1.25	.64			

Table 2.--Coal analyses of coal samples from the Wyodak and unnamed beds, Wasatch and Fort Union Formations, Campbell County, Wyoming--Continued

Sample No.	Type of analysis	Proximate analysis (percent)				Ultimate analysis (percent)					Heating value (Btu/lb)	Forms of sulfur (percent)			Ash-fusion temp. (°F)		
		Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur		Sulfate	Pyritic	Organic	Initial deformation	Softening	Fluid
D218927	A	28.0	30.1	31.5	10.4	6.5	45.8	1.0	34.9	1.5	8,116	0.00	0.89	0.58	1,860	1,950	2,040
	B	---	41.8	43.8	14.4	4.7	63.6	1.4	13.9	2.0	11,275	.01	1.23	.81			
	C	---	48.8	51.2	---	5.4	74.3	1.6	16.2	2.4	13,175	.01	1.44	.95			
D218928	A	29.5	32.1	33.0	5.4	6.7	48.7	1.1	37.8	.4	8,482	.01	.06	.38	2,170	2,260	2,370
	B	---	45.5	46.9	7.6	4.8	69.0	1.5	16.4	.6	12,027	.01	.09	.54			
	C	---	49.3	50.7	---	5.2	74.7	1.6	17.7	.7	13,018	.01	.09	.58			
D218929	A	21.6	37.8	30.6	10.0	6.7	51.7	1.2	28.9	1.5	9,409	.00	1.09	.45	1,860	1,950	2,060
	B	---	48.2	39.1	12.7	5.5	65.9	1.5	12.3	2.0	11,998	.00	1.40	.58			
	C	---	55.2	44.8	---	6.3	75.5	1.8	14.2	2.3	13,750	.00	1.60	.66			
D218930	A	27.9	32.9	31.6	7.6	6.5	48.0	1.0	36.1	.8	8,426	.03	.14	.66	1,970	2,080	2,190
	B	---	45.7	43.8	10.5	4.8	66.6	1.4	15.6	1.2	11,689	.04	.19	.92			
	C	---	51.0	49.0	---	5.3	74.4	1.6	17.4	1.3	13,059	.05	.21	1.03			
D218931	A	29.2	32.9	33.0	4.9	6.6	48.8	1.0	38.3	.4	8,443	.01	.03	.33	2,090	2,170	2,290
	B	---	46.5	46.5	7.0	4.8	68.9	1.4	17.5	.5	11,922	.02	.04	.47			
	C	---	50.0	50.0	---	5.1	74.0	1.5	18.8	.6	12,816	.02	.05	.50			
D218932	A	20.1	35.1	29.6	15.2	6.2	47.5	1.1	27.8	2.3	8,623	.01	1.63	.63	2,070	2,160	2,280
	B	---	43.9	37.1	18.0	5.0	59.4	1.3	12.5	2.8	10,789	.01	2.04	.79			
	C	---	54.2	45.8	---	6.1	73.4	1.6	15.4	3.5	13,325	.01	2.52	.98			
D218933	A	24.4	32.1	34.3	9.2	6.2	49.1	1.1	33.4	1.1	8,660	.01	.18	.88	2,050	2,170	2,260
	B	---	42.5	45.4	12.1	4.7	65.0	1.4	15.4	1.4	11,463	.01	.24	1.16			
	C	---	48.3	51.7	---	5.3	74.0	1.6	17.6	1.6	13,044	.01	.27	1.32			
D218934	A	28.8	29.5	37.1	4.6	6.5	49.5	1.1	38.1	.3	8,545	.01	.04	.27	2,260	2,340	2,430
	B	---	41.3	52.3	6.4	4.6	69.4	1.5	17.7	.5	11,994	.02	.05	.38			
	C	---	44.2	55.8	---	4.9	74.2	1.6	18.9	.5	12,817	.02	.06	.40			
D218935	A	25.5	30.0	29.6	14.9	6.3	43.6	1.0	33.7	.5	7,676	.01	.02	.52	2,380	2,490	2,580
	B	---	40.3	39.7	20.0	4.6	58.5	1.4	14.8	.7	10,304	.01	.03	.69			
	C	---	50.4	49.6	---	5.8	73.1	1.8	18.5	.9	12,875	.01	.04	.87			
D218936	A	26.8	28.6	36.3	8.3	6.2	47.6	1.0	35.3	1.6	8,301	.00	1.44	.12	1,890	2,000	2,100
	B	---	39.1	49.5	11.4	4.4	65.0	1.4	15.8	2.1	11,337	.01	1.97	.16			
	C	---	44.1	55.9	---	5.0	73.3	1.5	17.8	2.4	12,790	.01	2.22	.18			

Table 2.--Coal analyses of coal samples from the Wyodak and unnamed beds, Wasatch and Fort Union Formations, Campbell County, Wyoming--Continued

Sample No.	Type of analysis	Proximate analysis (percent)				Ultimate analysis (percent)					Heating value (Btu/lb)	Forms of sulfur (percent)			Ash-fusion temp. (°F)		
		Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur		Sulfate	Pyritic	Organic	Initial deformation	Softening	Fluid
D218937	A	29.3	28.7	36.9	5.1	6.5	49.1	1.1	37.9	0.3	8,448	0.01	0.04	0.30	1,920	2,010	2,090
	B	---	40.6	52.1	7.3	4.5	69.4	1.5	16.8	.5	11,949	.01	.05	.42			
	C	---	43.8	56.2	---	4.9	74.9	1.6	18.2	.5	12,886	.01	.06	.45			
D221583	A	21.4	33.7	34.2	10.7	5.3	51.0	.7	31.8	.6	8,791	.03	.26	.27	2,230	2,290	2,370
	B	---	43.8	43.6	13.6	3.7	64.8	.9	16.3	.7	11,178	.04	.33	.35			
	C	---	49.6	50.4	---	4.2	75.0	1.0	18.9	.8	12,940	.05	.38	.40			
D221584	A	22.7	32.9	40.1	4.3	5.4	55.6	.8	33.7	.2	9.499	.00	.05	.18	2,040	2,120	2,210
	B	---	42.6	51.8	5.6	3.8	71.9	1.0	17.5	.3	12,282	.01	.06	.23			
	C	---	45.1	54.9	---	4.0	76.1	1.0	18.6	.3	13,008	.01	.07	.24			
D221585	A	18.9	33.6	39.8	7.7	5.4	55.8	.8	29.3	1.0	9,685	.01	.48	.46	1,940	2,030	2,150
	B	---	41.4	49.2	9.4	4.1	68.8	1.0	15.5	1.2	11,936	.01	.59	.57			
	C	---	45.7	54.3	---	4.5	76.0	1.1	17.1	1.3	13,179	.01	.65	.63			